



## Innovations, Capabilities and Applications of the NASA-Glenn Vision Research and Human Health Diagnostics Laboratory

[What is the Lab's Objective?](#)

[Lab Overview in Support of  
Space Exploration \(Human Health and Performance\)](#)

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### Medical Applications

Innovations (click titles to view PDF presentations)	Current Projects (Diseases/Studies relevant to NASA / general public / both)	Users/Collaborators (click for biographies and photos)	References <b>Comment:</b> Aren't there more links that need to be here?
<p><a href="#"><b>Dynamic Light Scattering</b></a>    <i>(in clinical/experimental use, and fully automated)</i>   </p>	<ul style="list-style-type: none"> <li>• Effects of radiation </li> <li>• Effects of hyperbaric oxygen </li> <li>▪ <b>Astronaut radiation cataract monitoring</b> </li> <li>• Corneal diseases and wound healing (from LASIK) </li> <li>• Lens aging and cataracts </li> <li>• Uveitis</li> <li>▪ Glaucoma </li> <li>• Pharmacologic vitreolysis </li> <li>• Drug efficacy studies </li> <li>• Alzheimer's disease </li> <li>• Cholesterol</li> <li>• Diabetic vitreopathy </li> </ul>	<p>M.B. Datiles, MD (NEI)  S. Zigler, PhD (NEI)  J. Sebag, MD (USC)  F. Giblin, PhD (Oakland U)  J. Clark, PhD (Wash. U)  M. Chenault, PhD (FDA)  F.K. Manuel, OD (JSC)  J.A. Jones, MD (JSC)  J.B. Clark, MD (JSC)</p>	<ul style="list-style-type: none"> <li>• <a href="#">J. Biomed. Optics, 9(1) 22-37, 2004.</a></li> <li>• <a href="#">SPIE Proc., Vol. 4951, 168-176, 2003.</a></li> <li>• <a href="#">Exp. Eye Res., 74(1) 93-102, 2002.</a></li> <li>• <a href="#">Diab. Tech. &amp; Ther., 4(5) 651-659, 2002.</a></li> <li>• <a href="#">Exp. Eye Res., 73, 859-866, 2001.</a></li> <li>• <a href="#">SPIE Proc., Vol. 4245, 2001.</a></li> <li>• <a href="#">SPIE Proc., Vol. 3908, 38-49, 2000.</a></li> <li>• <a href="#">SPIE Proc., Vol. 3908, 69-77, 2000.</a></li> <li>• <a href="#">Duane's Clinical Ophthalmology</a></li> <li>• <a href="#">Review of Refractive Surgery, May 2002</a></li> <li>• <a href="http://www.medicaldesign.com/articles/ID/12106">www.medicaldesign.com/articles/ID/12106</a></li> <li>• <a href="http://science.nasa.gov/headlines/y2004/22oct_cataracts.htm">science.nasa.gov/headlines/y2004/22oct_cataracts.htm</a></li> <li>• <a href="http://www.vrs-online.com/abstracts/6_99.html">www.vrs-online.com/abstracts/6_99.html</a></li> <li>• <a href="http://www.pslgroup.com/dg/243f62.htm">www.pslgroup.com/dg/243f62.htm</a></li> <li>• <a href="http://gltrs.grc.nasa.gov/reports/2002/TM-2002-211361.pdf">gltrs.grc.nasa.gov/reports/2002/TM-2002-211361.pdf</a></li> <li>• <a href="http://www.nasa.gov/audience/formedia/speeches/ok_colorado_springs_033104.html">www.nasa.gov/audience/formedia/speeches/ok_colorado_springs_033104.html</a></li> <li>• <a href="http://hutchison.senate.gov/ccnasa4.htm">http://hutchison.senate.gov/ccnasa4.htm</a></li> </ul>
<p><a href="#"><b>Corneal/Lens Autofluorescence</b></a>  <i>(Used in clinical</i></p>	<ul style="list-style-type: none"> <li>• Radiation-induced biological effects</li> <li>▪ Diabetic retinopathy</li> </ul>	<p>L. Rovati, PhD (U-Modena)  M.B. Datiles, MD (NEI)</p>	<ul style="list-style-type: none"> <li>• <a href="#">SPIE Proc., Vol. 4245, 1-7, 2001.</a></li> <li>• <a href="#">SPIE Proc., Vol. 4611, 213-219, 2002.</a></li> <li>• <a href="#">J. Biomed. Optics, 9(91) 9-21, 2004.</a></li> </ul>

## Vision Research and Human Health Diagnostics Lab Technology Summary

<p><b><i>studies)</i></b></p>  			
<p><b>Laser-Doppler Flowmetry</b> <i>(flew on KC-135)</i></p>  <p><i>(miniature sensor in astronaut glove for EVA/NBL study under development)</i></p>	<ul style="list-style-type: none"> <li>• Circulatory physiology <b>in space</b> </li> <li>• Hemodynamic response</li> <li>• Choroidal blood circulation </li> <li>• Age-related macular degeneration (AMD)</li> <li>• Diabetic retinopathy</li> </ul>	F.K. Manuel, OD (JSC) J.A. Jones, MD (JSC)	<ul style="list-style-type: none"> <li>• Invest. Ophthalmol. Vis. Sci., 45, E-Abstract 2624, 2004.</li> <li>• <a href="#">SPIE Proc., Vol. 4951, 177-184, 2003.</a></li> <li>• <a href="#">Review of Refraction Surgery, November 2003</a></li> <li>• <a href="http://optics.org/articles/news/9/3/14/1">http://optics.org/articles/news/9/3/14/1</a></li> </ul>
<p><b>Raman Carotenoid Pigment Dispersion Analysis</b></p> 	<ul style="list-style-type: none"> <li>• Nutrition &amp; dietary supplements (lutein/xeaxanthin)</li> <li>• Age-related macular degeneration (AMD)</li> <li>• Skin cancer</li> <li>• Stress status of living plants and plant products</li> <li>• Aqueous chemistries to index blood values</li> </ul>	N. Congdon, MD, MPH (Johns Hopkins U) J. Kaplan, PhD (Wake Forest U)	<ul style="list-style-type: none"> <li>• J. Biomed. Optics, 9(1) 75-85, 2004.</li> <li>• J. Biomed. Optics, 9(1) 139-148, 2004.</li> </ul>
<p><b>Ocular Polarimetry</b> <i>(under development)</i></p> 	<ul style="list-style-type: none"> <li>• Blood-glucose sensing</li> </ul>	M.B. Datiles, MD (NEI) L. Rovati, PhD (U-Modena)	<ul style="list-style-type: none"> <li>• <a href="#">J. Biomed. Optics, 9(1) 103-115, 2004.</a></li> <li>• <a href="#">SPIE Proc. Vol. 4965, 116-121, 2003.</a></li> <li>• <a href="http://www.islet.org/forum/messages/37412.htm">www.islet.org/forum/messages/37412.htm</a></li> <li>• <a href="http://www.diabeteshealth.com/read,1009,3244.html">www.diabeteshealth.com/read,1009,3244.html</a></li> </ul>

## Vision Research and Human Health Diagnostics Lab Technology Summary

 <b>Tissue Oximetry (flown on KC-135)</b>  <i>(miniature sensor in astronaut glove for EVA/NBL study under development)</i> 	<ul style="list-style-type: none"> <li>• Muscle atrophy and osteoporosis <b>(in space)</b></li> <li>• Bed rest/exercise studies</li> <li>• <b>Blood circulation in head/muscle tissue</b></li> <li>• <b>Functional brain imaging</b></li> <li>• <b>Cardio-pulmonary surgery (OR/IC unit)</b></li> </ul>	J.A. Jones, MD (NASA JSC) J.B. Clark, MD (NASA JSC) M. Cabrera, PhD (CWRU) P. Cavanagh, PhD (Cleveland Clinic)	<ul style="list-style-type: none"> <li>• The Scientist, Vol. 19, 25-27, 2005.</li> </ul>
<b>Tissue Capillaroscopy (in design stage for use in conjunctiva)</b> 	<ul style="list-style-type: none"> <li>• Micro-circulation/blood vessel tortuosity</li> <li>• <b>Functional imaging of blood flow</b></li> </ul>	Y. Gurfinkel, MD, PhD (MSU)	
<b>Vertical Vergence Amplitude Measurement (in initial design stage)</b> 	<ul style="list-style-type: none"> <li>• Fatigue and alertness monitoring</li> </ul>	A. Sadun, MD, PhD (USC) J. Sebag, MD, FACS, FRCOphth (USC)	
<b>Celestial/Terrestrial Tele-Medicine</b> <i>(all of the above in an</i>	<ul style="list-style-type: none"> <li>• Ocular and systemic disease detection</li> </ul>	J. Sebag, MD, FACS, FRCOphth (USC)	<ul style="list-style-type: none"> <li>• <a href="#">SPIE Proc., Vol 4245, 1-11, 2001.</a></li> </ul>

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*integrated head-mounted  
goggle-like diagnostic  
device, under  
development)*

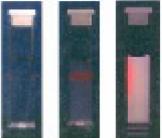
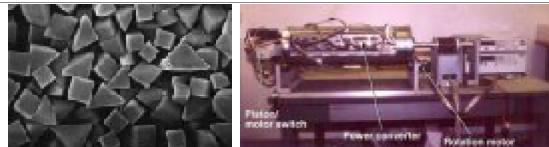


Project		References
<b>Real-Time Monitoring for Cell-Growth</b> (Bioreactor)		▪ <a href="#">SPIE Bios, 2004.</a>
<b>Real-Time Monitoring of Protein Crystallization</b> (in a Hanging Droplet)		▪ Proc. SPIE Bios Europe, 2629 (23), 1995.
<b>Nucleation and Growth of Protein Crystallization</b> (in NASA Flight Hardware)		▪ <a href="#">J. Crystal Growth, 168, 216-226, 1996.</a>

## Chemical Engineering Applications

Project		References
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<p><b>Characterization of Turbid Media</b> (Particle sizing for high concentration dispersion, suspension, and slurry)</p>		<ul style="list-style-type: none"> <li>▪ Proc. Coherence Domain Optical Methods in Biomedical Science and Clinical Applications II, 3251, 146-156, 1998.</li> <li>▪ <a href="#">J. Jpn. Soc. Microgravity Appl., 15, 186-193, 1998.</a></li> </ul>
<p><b>On-Line Monitoring for Industrial Quality Control Applications</b> (Particle sizing in flow)</p>		<ul style="list-style-type: none"> <li>▪ <a href="#">Proc. SPIE Bios, 4965, 147-152, 2003.</a></li> </ul>
<p><b>Zeolite Crystals</b></p>		<ul style="list-style-type: none"> <li>▪ <a href="#">J. Phys. Chem., 100, 9870-9880, 1996.</a></li> </ul>
<p><b>Pollution Control -- Water Quality Monitoring</b> (Flocculation and aggregation)</p>		<ul style="list-style-type: none"> <li>▪ 2nd Microgravity Fluids Physics Conference, 1994.</li> </ul>

## Instrumentation Development

Project		References
<p><b>Miniaturized Fiber-Optic Multi-angle SLS/DLS System</b></p>		<ul style="list-style-type: none"> <li>▪ <a href="#">J. Jpn. Soc. Microgravity Appl., 15, 186-193, 1998.</a></li> </ul>
<p><b>Compact Fiber-Optic Probes for Dynamic Light Scattering, Autofluorescence, Raman Scattering</b></p>		

US Patents: ([5,284,149](#)) ([5,973,779](#)) ([6,704,588](#))

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